Unit 1

Weed Management in Paddy Crop

INTRODUCTION

Other unnecessary plants can, generally, be seen growing along with crop plants in a paddy field. These other plants, which have not been sown, are ‘weeds’. They are wild in nature. Weeds grow on their own because their seeds are already present in the field or could have got mixed with paddy crop seeds or transplanting material.

Weeds compete with crop plants for space, nutrients, water and sunlight. Besides, they interfere with the field operations, harbour insects–pests, cause an increase labour costs, degrade the quality of the produce and reduce the yield. An estimated total loss in paddy yield by weeds is about 37 per cent, insects 29 per cent, diseases 22 per cent and animals 12 per cent*.

Checking weed population in a paddy field is of utmost importance. It implies that pure quality seeds must be used and the field must be prepared in such a manner that there is least chance of weed seeds creeping in before sowing of the main crop. Then, comes control, wherein, weeds and other undesirable plants are removed from the field by manual, mechanical, biological or chemical methods.

*__Source:__ *Dhan ki Vaigyanik Kheti* (2016), Indian Council of Agricultural Research, Pusa, New Delhi

WEEDS

These are undesirable wild plants, especially, growing among crop or garden plants. They compete with the main plant for nutrients, water, sunlight and space.

Characteristics of weeds

They are the earliest intruders in farmlands, and agricultural fields are virtually never free of them. Some of the prominent characteristics of weeds are as follows.

- Weeds can grow anywhere and in adverse weather conditions.
- Weeds exhibit the ability to germinate faster than the main crop.
- Many of them can multiply through both seeds and vegetative parts.
- Generally, weeds mature early and spread their seeds well before the harvest of the main crop.
- Weed seeds can survive for a longer period.

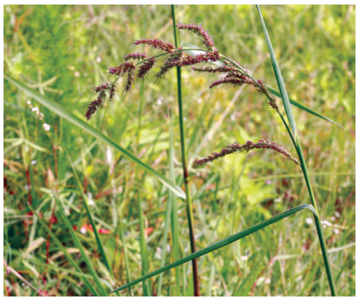

Fig. 1.1: Shama or jungle rice (Echinochloa colona)

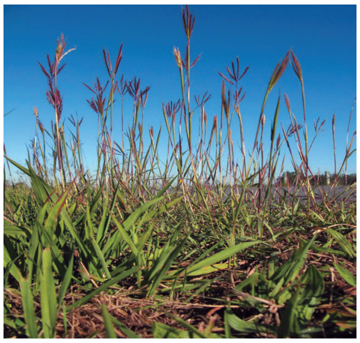

Fig. 1.2: Marvel grass (Dichanthium annulatum)

SESSION 1: COMMON WEEDS IN A PADDY FIELD AND THEIR EFFECTS ON PADDY CULTIVATION

Common weeds in paddy field

Grasses

The leaves of grasses are long and narrow with parallel veins. Their leaves emerge in alternate patterns between internodes. The root system of grasses is fibrous. Grasses are, generally, the most difficult weeds to control in a rice crop field, especially, during early crop stage (Fig. 1.1 to 1.5).

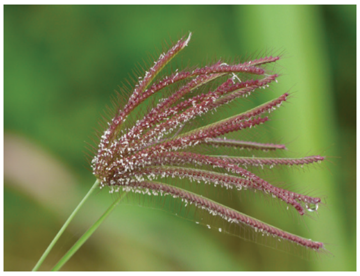

Fig. 1.3: Swollen finger grass or peacock plume grass (Chloris barbata)

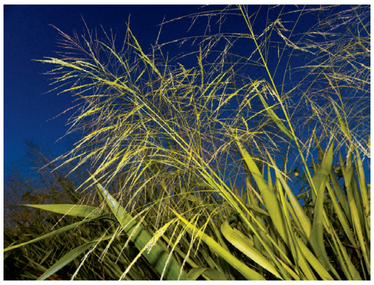

Fig. 1.4: Kutki or blue panic grass (Panicum spp.)

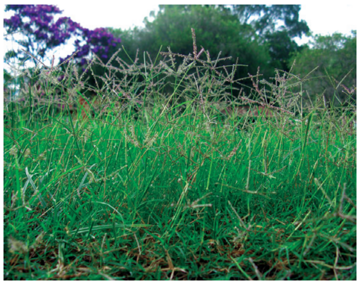

Fig. 1.5: Doob or bermuda grass (Cynodon dactylon)

Sedges

These are similar to grasses. But they have triangular solid stems and closed leaf sheaths. They are semi-aquatic plants, which require moist or flooded soils, and are the most common problem in rice fields (Fig. 1.6 and 1.7).

Broad-leaved weeds

These are plants with netted veins across the leaf lamina. They can further be distinguished by their roots, which have taproot system (Fig. 1.8 to 1.20).

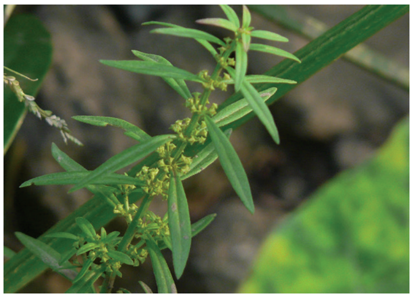
Fig. 1.6: Jungli mehendi or blistering ammannia or dadmari (Ammania baccifera)

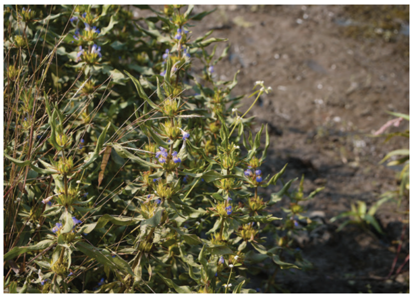
Fig. 1.7: Gokhula kanta or gokshura (Asteracantha longifolia)

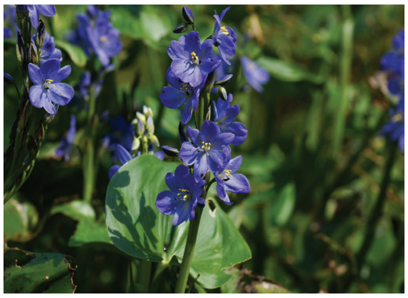
Fig. 1.8: Nanka or oval leaf pond weed (Monochoria vaginalis)

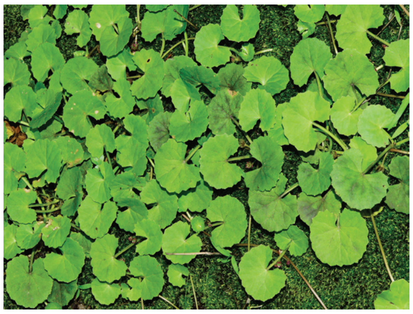
Fig. 1.9: Indian water navelwort or brahmi (Centella asiatica)

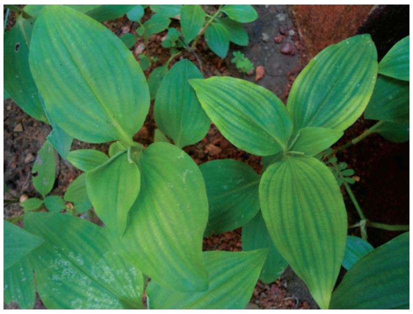
Fig. 1.10: Kankawa or Bengal day flower (Commelina benghalensis)

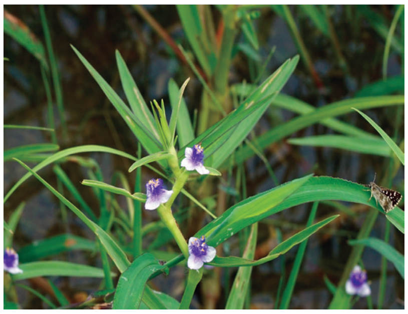
Fig. 1.11: Kana or creeping cradle plant (Cynotis axillaris)

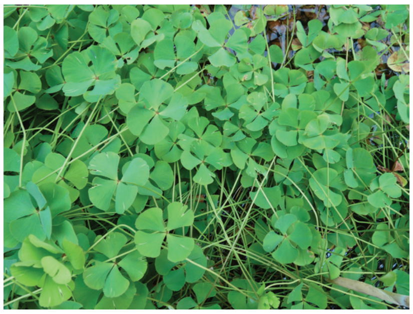
Fig. 1.12: Caupatiya or sunsuniya or water clover (Marselia quadrifolia)

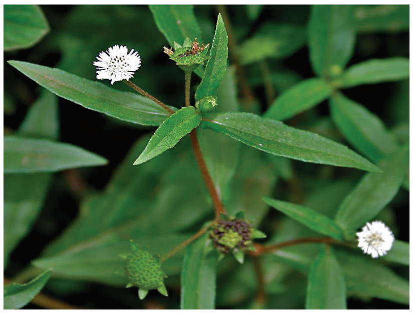
Fig. 1.13: Bhringaraj or false daisy or karisalankanni (Eclipta prostrata)

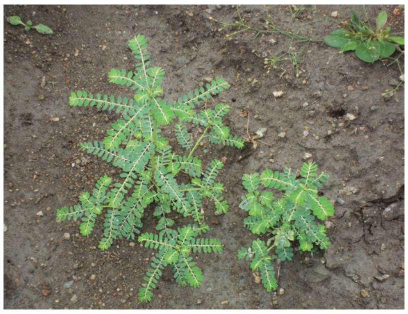
Fig. 1.14: Bhui aonla (Phyllanthes niruri)

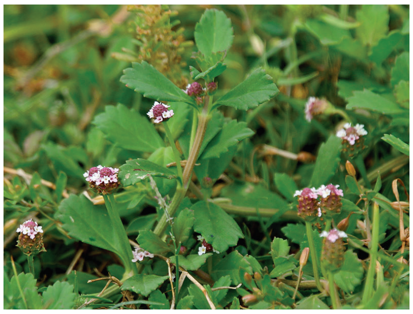

Fig. 1.15: Bukkan (Phyla nodiflora)

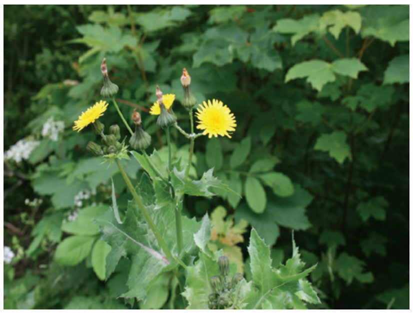

Fig. 1.16: Dudhi (Sonchus olaraceus)

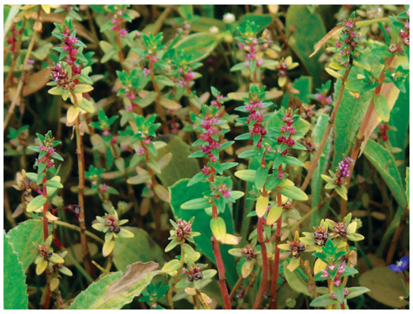

Fig. 1.17: Jalmukhi (Rotala densiflora)

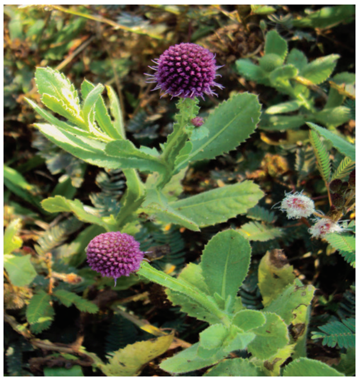

Fig. 1.18: Gul mundi (Sphaeranthus indicus)

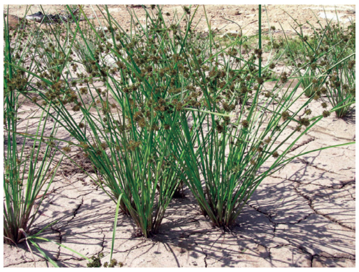

Fig. 1.19: Motha (Cyperus difformis)

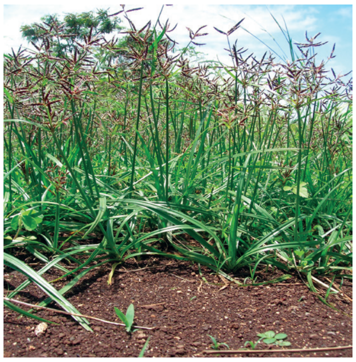

Fig. 1.20: Bara nagar motha (Cyperus rotundus)

Classification of weeds

Based on life cycle

Some weeds complete their life cycle in one season or year, some in two seasons or years and some take longer. Thus, on the basis of life cycle, weeds are grouped into three categories, which are discussed as follows.

Annuals

These weeds complete their life cycle within a season or year and, generally, propagate through seeds, which are produced in large numbers. These may be summer or rainy season weeds.

Biennials

These weeds complete their life cycle in two seasons or years. They complete their vegetative phase in the first season and reproductive phase, i.e., flowering and seed setting, in the second season.

Perennials

These weeds complete their life cycle in more than two years or seasons and may survive indefinitely. They propagate by seeds or vegetative parts, such as rhizome, stolons, bulbs, tubers, stem, roots, suckers, etc.

Based on cotyledons

On the basis of cotyledons, weeds may be classified into monocots or dicots. This classification is important while selecting the type of chemicals for controling weed population.

Monocot weeds

Weed species having single cotyledon are called monocot weeds. These may include grasses, sedges, etc.

Dicot weeds

Weed species having two cotyledons or seed leaves are called dicot weeds. They are also referred to as broad-leaved weeds.

Effects of weeds on paddy cultivation

- Weeds compete with the main crop for space, sunlight, water and nutrients. They suppress the growth of the main crop, adversely affect the quality of the crop and reduce the yield, thereby, causing reduction in the market price of the crop.
- Weeds act as alternate host to insects and pests during off-cropping season.
- The presence of weeds in a paddy field increases the cost of crop production through tillage operations and weed control measures.
- Weeds reduce the yield in different rice varieties by up to the following percentages.

Upland direct seeded rice:	35–45 per cent reduction in yield
Direct seeded on puddle land:	20–25 per cent reduction in yield
Transplanted rice:	10–15 per cent reduction in yield

Crop–weed competition

Crop–weed competition does not kill the crop or weeds. Its major impact is by the way of reduced yield. The extent of crop–weed competition depends on the following major factors.

Planting density

High crop plant density provides less opportunity to weeds for competition.

Growth stage of crop

Early growth stage of crop at the time of weed infestation results in reduced yield as compared to the later stage.

Weed density

More number of weed plants per unit area causes more losses to the main crop.

Rice varieties and their growth pattern

Rice varieties, which have an early and faster growth rate, are less prone to weed competition.

Critical phase of weed competition

The critical period of weed competition is 15–45 days from transplanting in lowland transplanted rice and throughout the growth period in upland rice. Weeding during this period produces almost similar yield compared to that obtained under weed-free conditions. Weed management during this phase gives maximum economic returns.

Practical Exercise

Activity

Visit a nearby paddy field and identify the weeds found there. Paste the samples of the weeds that you have identified in a herbarium file and label them.

Material required: writing material, herbarium file and weed samples

Procedure

- Visit a nearby paddy field and identify the weeds found there.
- Collect the weed samples.
- Paste the samples in a herbarium file and label them, mentioning the botanical names of the weeds. Also, write measures to control the spread of such weeds.
- Present it before the class.

Check Your Progress

A. Fill in the Blanks

1. An undesirable plant, which grows in the main field is called _________.
2. Weeds can multiply through ________________ and _____________ parts.
3. The stage of crop, which causes maximum crop loss by weeds, is termed ____________ period.

4. Weed competition causes reduction in the crop yield by 35–45 per cent in __________ rice.
5. Weeds completing their life cycle within a season or year are known as ________.

B. Multiple Choice Questions

1. Weed is an _____________.
   (a) unwanted plant
   (b) desirable plant
   (c) beneficial plant
   (d) All of the above
2. Weeds surviving for more than two years or seasons are known as _____________.
   (a) annuals
   (b) biennials
   (c) perennials
   (d) None of the above
3. Weed plants, which require flooded soils, are known as _______________.
   (a) sedges
   (b) grasses
   (c) broad-leaved weeds
   (d) All of the above
4. The critical period of weed competition for lowland transplanted rice is ____________ days after transplanting.
   (a) 30–50
   (b) 15–45
   (c) 20–60
   (d) 25–60

C. Subjective Questions

1. Define weeds and list their characteristics.
2. List the common weeds found in a paddy field.
3. Describe the classification of weeds.
4. Differentiate between the following.
   (a) Grassy and broad-leaved weeds
   (b) Annual and perennial weeds

D. Match the Columns

A	B
1. Fibrous root	(a) Less weed competition
2. More yield reduction	(b) Grasses
3. Taproot	(c) Triangular solid stems
4. High crop plant density	(d) Broad-leaved weeds
5. Sedges	(e) Early weed infestation

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SESSION 2: WEED MANAGEMENT

Annual loss in agriculture production is maximum due to weeds, followed by insects–pests and diseases. Weeds can be managed by different methods, such as cultural, mechanical, biological and chemical. Using chemicals should, however, be the last option, keeping in mind the safety of the environment.

Measures to minimise weed infestation

Preventive measures

Checking the occurence and spread of weeds in a paddy field is a preventive method of weed control. One can check the spread of weeds by taking the following measures.

- Taking care while transplanting seedlings
- Removal of weeds along irrigation channels and bunds
- Sowing weed-free seeds
- Using clean implements
- Using decomposed manure(s)
- Using pre–emergence herbicides

Control measures

These include cultural, mechanical, biological and chemical methods of weed control. Each of these methods has its own merits and demerits. Farmers can choose any of these method or a combination of these to control weeds effectively and economically.

Weed control management practices

Cultural methods

These involve various agronomical practices, such as crop rotation, summer ploughing, field sanitation, time of sowing, use of fertiliser, etc., which help prevent and reduce weed population. These prove to be more effective when used in combination.

Crop rotation

Growing different crops in the same field in successive seasons or years helps reduce weed population and checks their occurence.

Sanitation

Field and irrigation channels should be made free of weeds as it will help restrict the multiplication and entry of weeds in a farm.

Summer ploughing

Deep ploughing during summer season exposes underground parts of perennial weeds like rhizomes and tubers to heat. These weeds are killed after being exposed to high temperatures.

Planting density

Dense planting helps suppress the germination and growth of weeds in a field.

Mechanical methods

The basic measure followed to check weed population is ploughing, which is primarily done for land preparation. However, it also helps in uprooting annual weeds and cuts the roots of annual and perennial weeds at the same time. Conoweeder is used for carrying out weeding in standing crop effectively.

Physical methods

These methods include hand pulling, hoeing, tilling, mowing, burning, flooding, smothering, etc.

Biological methods

In this method, a natural enemy of weed plants, i.e., predators, pathogens and parasites are used to control a specific weed population.

Chemical methods

These relate to measures, in which chemicals (herbicides) that kill unwanted plants are used. This is a

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time-saving and effective method of weed management. Many chemicals function on the basis of selective preference *viz.*, a chemical would kill a specific weed plant, without affecting the other crop plant.

Advantages of chemical weed control

- Chemical methods of weed control are more economical, and hence, affordable than hand weeding.
- These methods are less time-consuming and easier to carry out.
- These are the most effective methods compared to other methods of weed control.
- These are suitable for closely spaced crops.

Herbicides

Herbicides are chemicals that are poisonous to plants and are used to kill unwanted plants. Different types of herbicide need to be used at different stages of cropping or planting.

Stage of planting and application

Pre–planting: This refers to the application of herbicide(s) crop planting. Non-selective herbicides are sprayed on existing vegetation to kill weeds before planting or sowing of the main crop, for example *paraquat*, *glufosinate*, etc.

Pre–emergence: This involves the application of herbicide(s) after sowing but prior to the emergence of weeds. Application of herbicides is done prior to weed emergence at 1–3 days after sowing and transplanting. Examples are *benthiocarb* @ 1.0–1.5 kg/ha, *butachlor* @ 1.0–1.5 kg/ha, *oxadiazon* @ 0.5–0.75 kg/ha, *oxadiargyl* @ 0.08–0.10 kg/ha, *pyrazosulfuron-ethyl* @ 0.020–0.025 kg/ha, etc.

Post–emergence: This involves the application of herbicide(s) after the emergence of weeds. The herbicides are applied, usually, at 3–4 leaf stage of weed for better efficacy and control. Examples are *metsulfuron methyl* @ 4–8 g/ha, bentazon @ 1.0–1.5 kg/ha, *bispyribac sodium*

@ 0.020–0.025 kg/ha and 2,4–D @ 0.5 kg/ha (used to control broad-leaved weeds), etc.

Precautions during herbicide application

- Always wear personal protective equipment, such as mask, goggles, gloves and protective clothing at the time of herbicide application.
- Always apply herbicides as per the recommended method, rate and crop stage.
- Mixing muddy water with herbicide reduces efficacy. Therefore, a person must always use clean water.
- After use, clean all parts of the sprayer, such as tank, boom and nozzle. It is done for the maintenance of the sprayer.

Practical Exercise

Activity

Demonstrate chemical method of weed control.

Material required: weedicides, sprayer and personal protective equipment like gloves, gumboots, goggles, etc.

Procedure

- Identify different types of weed in a paddy farm.
- Select chemicals used for pre– and post–emerging weeds.
- Prepare a chemical solution for spraying as the per the recommended dosage.
- Follow the recommended safety measures during the application of weedicides.
- Spray weedicides in the paddy field.
- Write the observation(s) noticed in the farm after 10 days in your notebook.
- Present your observations before the class.

Check Your Progress

A. Fill in the Blanks

1. The application of herbicides in a field after seeding or planting is called _____________ application.
2. 2, 4–D weedicide is used to control _______________ weeds.
3. Chemicals used for controlling weeds are called ________.
4. Weed control by conoweeder is an example of _________________ method.

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B. Multiple Choice Questions

1. The most effective and time-saving method of managing weeds is ____________.
   (a) mechanical method
   (b) biological method
   (c) chemical method
   (d) cultural method
2. The application of herbicides in a field before sowing or planting is termed _____________.
   (a) pre–emergence application
   (b) pre–plant application
   (c) pre–sowing application
   (d) None of the above
3. Herbicide used after sowing or planting of the crop is ________________.
   (a) *Butachlor*
   (b) *Bentazon*
   (c) *Metsulfuron*
   (d) *Glufosinate*
4. The application of herbicides in a field after the emergence of weeds is called _____________.
   (a) post–emergence application
   (b) pre–emergence application
   (c) post–sowing application
   (d) None of the above

C. Subjective Questions

1. Describe cultural methods of weed control in paddy crop.
2. Describe chemical method of weed control in paddy crop.
3. Differentiate between pre– and post–emergence herbicides with examples.

D. Match the Columns

A	B
1. Hand weeding	(a) Cultural method
2. Crop rotation	(b) Biological control
3. Metsulfuron methyl	(c) Physical method
4. Natural enemy	(d) Post–emergence herbicide